



Staff Report

INFORMATIONAL REPORT REGARDING THE CITY OF BELMONT PAVEMENT MANAGEMENT PROGRAM AND OVERALL CONDITION OF STREETS IN BELMONT

Honorable Mayor and Council Members:

Summary

The purpose of this report is to describe the City's pavement management program and the condition of the overall pavement system in the City of Belmont.

There are three key benefits resulting from the City of Belmont's use of a Pavement Management Program to establish the City Pavement Maintenance and Improvement Program. First, it is required in order for the City to be eligible for funding allocated under the state transportation program. Second, the system provides a best practices method to prioritize city streets for preventative maintenance, rehabilitation, or reconstruction that is based on a fair and systematic approach to evaluating pavement condition. Third, the program assists the City in determining how best to use limited funds to their maximum benefit.

Staff will present a second report seeking Council direction into the street rehabilitation priority list at a future date, discussing options the City may consider reducing the City deferred maintenance backlog.

Background

Pavement Management Program

In 1970, the State of California formed the Metropolitan Transportation Commission (MTC) to manage San Francisco Bay Area transportation planning and financing. MTC's mission includes assisting local agencies with pavement management. In the 1980s, MTC determined that Bay Area pavement was deteriorating because local agencies were funding only half the needed maintenance.

MTC requires local agencies to develop and adopt a pavement management program plan as a condition of state grant eligibility (California Streets and Highway Code, Section 2108.1). The program requires the City to maintain an inventory of City streets and identify sections needing rehabilitation or replacement and the associated budget. MTC assists cities through the PTAP program, which provides grants to fund cost of the detailed condition distress surveys that must be conducted.

The City uses Street Saver Program and the associated database to generate recommended maintenance and rehabilitation schedules and cost estimates. The program recommends the most cost effective way to dedicate resources. Over the next month, staff will use the program to generate recommendations for the most cost effective treatment that should be applied. The City's eligibility for funds would be diminished and in some cases funds not secured if the City pavement program doesn't follow the established criteria and instead focused on less cost effective approaches.

The program develops the most cost effective treatment for the pavement system overall, primarily by giving priority to low-cost preventative maintenance. Preventative maintenance is defined as the surface treatment of Good to Satisfactory condition pavement that has not yet started to show significant failure, but which will begin to fail in the near future. The program identifies those roadways at a critical point of failure where in the near future only a more costly treatment may be used to extend the life of the pavement. Streets requiring more costly structural rehabilitation or reconstruction are considered, but to a lesser extent as structural rehabilitation or reconstruction of failed roadways is not the most effective use of resources and there are not enough funds to both maintain good condition pavement and reconstruct the poor condition pavement.

StreetSaver is a valuable organizational tool, but the output is utilized in conjunction with professional judgment, familiarity with local conditions not considered by the program, and Council direction.

Asphalt Concrete Pavement - Evaluation

Nearly all of Belmont's public streets are constructed of flexible asphalt concrete (AC) pavement. Flexible pavement deflects when loaded, in contrast with rigid pavement such as portland cement concrete. Flexible AC pavement has three or more layers of load-bearing materials. All layers have different physical properties but all contribute to the total structural strength of the street. The composite layers are collectively known as the pavement structural section.

The top layer is typically three to twelve inches of asphalt concrete compacted to provide a smooth, water-resistant surface. AC is a mixture of asphalt and aggregate, and may include additives. Asphalt is a black, viscous hydrocarbon obtained from the heavy ends of petroleum distillation. When heated, it liquefies and is easy to mix and mold. When cool, it firms to a semi-solid or even brittle material. Aggregates are crushed rock, gravel and sand. When mixed and compacted with the asphalt binder, aggregates lock together to produce a stable, long-wearing, water resistant surface.

Supporting the AC layer are four to twelve inches of compacted gravel known as the aggregate base layer. Aggregate base contributes structural strength and also promotes drainage.

Beneath the aggregate base is a sub-grade of graded and compacted soil or an aggregate sub-base layer. Native soil is used if it has sufficient strength and stability. Otherwise, it is replaced with a thick layer of sub-base, an engineered fill consisting of balanced portions of silts, sands, and gravels.

Roadway Functional Classification

Engineers design the thickness of structural layers by balancing construction costs against the desired service life for the intended use and loading. Arterials such as Ralston Avenue are most expensive to construct because they need a thick structural section to handle frequent, heavy truck traffic. Collectors such as Masonic Avenue convey residential traffic to and from arterials. They have thinner sections and are less expensive to construct. Residential streets intended for low speed, local traffic can get by with the thinnest structural section.

Asphalt Concrete Pavement Condition Evaluation

The typical service life of AC pavement ranges from about 15 to 30 years, depending on its structural design and use. Flexible pavement can withstand only a finite number of loading deflection cycles before it breaks down. Environmental conditions such as water infiltration into the base layer and changes in temperature also contribute to the decline of pavement.

The visible deterioration of pavement can take many forms.

- Weathering and raveling describe loss of surface aggregates from aging asphalt binder that has worn away.
- Pavement cracks over time and as it ages and may form block cracking, which is cracks in a rectangular pattern. The intensity of cracking can vary.
- Repeated loading causes pavement to develop alligator cracking, or deep interlocking cracks that look like alligator skin. The intensity of alligator cracking can vary.
- Separated chunks of block cracked or alligator AC are easily dislodged to produce potholes as the severity increases.
- Overloaded pavement will distort and pavement will experience shoving or corrugation. These surface ruts and bumps develop from shifting of aggregate base and base layers due to shoving (vehicle braking) or subsurface instability.
- Trench cuts are localized pavement patches usually from utility repair, which often contribute to a weakening overall. The weakening becomes visible with the passage of time.

Pavement Condition Index

MTC's pavement condition index (PCI) is a ranking system that assesses, weighs, and combines various defects to give an overall indication of the pavement condition. The PCI scale runs from 0 to 100 as follows:

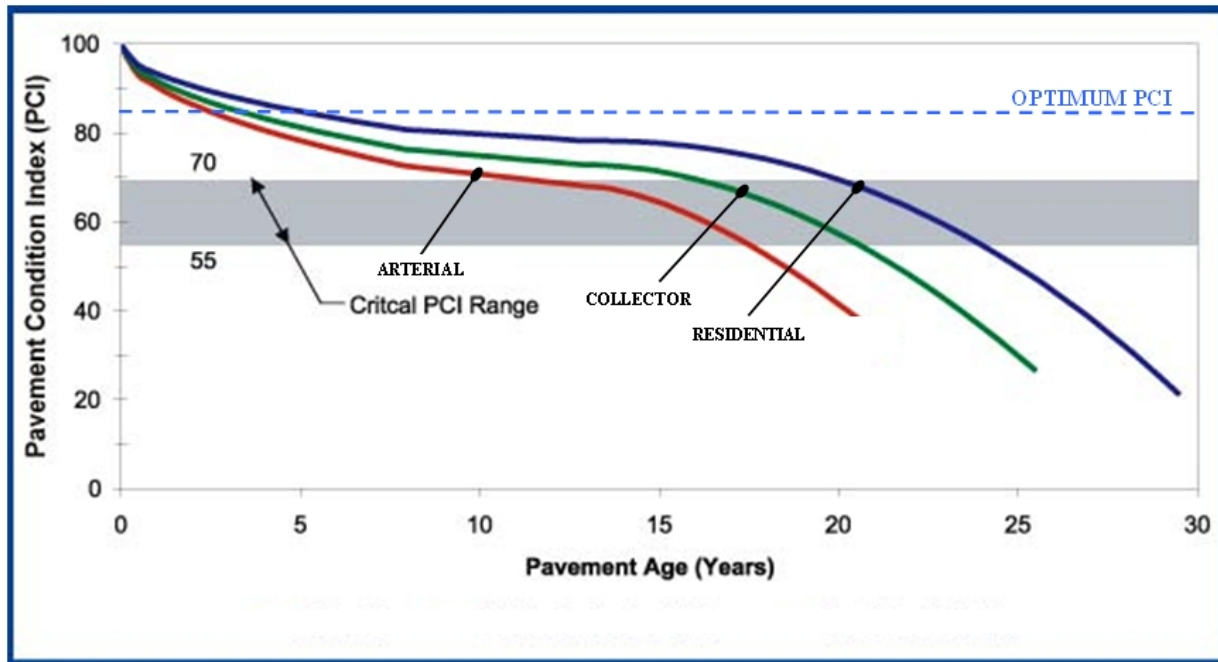
- 70 to 100 Good – Pavement is in fairly sound condition. There are very few cracks and little to no raveling. At lower end of range, pavement will most benefit from surface treatments to extend service life.
- 50 to 70 Satisfactory – Pavements show some form of distress caused by traffic load or environmental distress that require more than a life-extending treatment. Pavement is starting to show the signs of aging, such as longitudinal cracks. If the distress is load related, the pavement will show medium alligator cracking. The surface is usually more than 10 years old. Majority of streets can be treated with crack sealing or patching, with a surface treatment applied on top, but where the failure is load related thin to medium overlay is needed instead of slurry.
- 25 to 49 Fair – AC layer is failing and requires thick overlay or reconstruction. These streets are usually more than 20 years old.
- 0 to 24 Poor – Entire structural section has failed and the pavement and the sub-base require reconstruction. These streets are usually more than 30 years old.

The PCI is a quick method of comparing the overall condition of pavement and magnitude of rehabilitation needs. It does not provide sufficient information to describe the types, causes, and remedies for specific defects in a street segment.

Identify Pavement Rehabilitation and Reconstruction Needs

The following figure shows how pavement condition typically deteriorates over time. The new pavement holds its good condition for a long period, but once it begins to fail, its condition drops rapidly. Pavement is at the onset of rapid failure when its condition drops into the 70 to 55 PCI range.

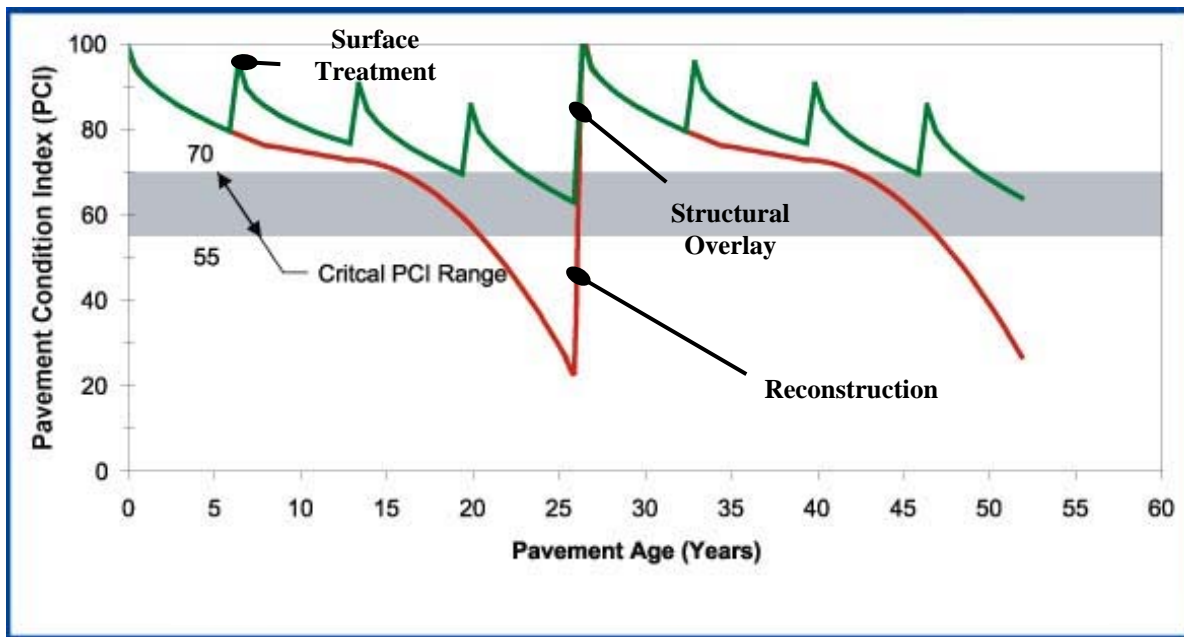
The optimum range is the PCI that MTC recommends communities maintain their pavement system at for lowest ongoing maintenance cost.



Extending Pavement Life through Maintenance and Rehabilitation

Pavement life can be extended at relatively low cost by timely maintenance and rehabilitation. MTC's recommended strategy is to prioritize funding to hold all good condition street segments at that level while using remaining available funds to rebuild poorer condition pavement. The regional goal is to eventually bring all Bay Area pavement up to a PCI range of 80 to 85. This is the PCI that yields the lowest long-term pavement maintenance cost, and is considered optimum.

The following figure compares two pavement management strategies. The first strategy allows the new pavement to deteriorate over a life of about 25 years. The failed pavement is then fully reconstructed. The second strategy uses a series of low cost surface treatments to keep the pavement condition above the critical PCI range. After about 25 years, this second pavement needs some structural rehabilitation, but it does not need complete reconstruction.



The table shows several treatment types, described as follows:

- **Surface Treatment.** A typical surface treatment is a slurry seal, which is an appropriate surface treatment for good condition pavement in an urban environment. A more expensive surface treatment is thin overlay, which is an appropriate treatment where pavement is in fair to good condition showing slight surface damage. Both slurry seals and thin overlays restore water resistance and improve the ride and appearance of aging, mottled or patched pavement. These treatments do not improve the strength of the roadway structural section.
- **Structural Overlay.** The next level of treatment is a thick AC overlay. A thick overlay is needed where there is a need to restore structural strength to a cracked AC layer and is appropriate when the underlying layers are still stable.
- **Reconstruction.** The final level of treatment is reconstruction. Where pavement has completely failed through the base layers, the roadway must be excavated and reconstructed. The most expensive repairs are to streets with unstable earth beneath the base layer.

The following table shows relative costs for these treatments. It also compares the amount of pavement that can be treated by a \$100,000 construction contract. All quoted costs are for typical construction and are not intended to represent actual Belmont street construction projects.

Pavement Treatment Obtained from \$100,000 Construction Contract		
Treatment	Cost per Square Yard	Amount of Treatment
Slurry Seal	\$2	50,000 yd ² or 25 lane miles
Thin Overlay	\$5 - \$15	10,000 yd ² or 5 lane miles
Structural Overlay	\$25 to \$35	3,000 yd ² or 2 lane miles
Reconstruction	\$85 to \$135	900 yd ² or 1/2 lane mile

City of Belmont Pavement Condition

The City's most recent pavement assessment was completed in November 2007. The 2007 survey showed that the overall average PCI for Belmont streets is 62, placing them in the mid-range of the satisfactory category. MTC reports that the overall average Bay Area PCI is 65 and Belmont is 15 out of the 19 jurisdictions in San Mateo County.

The Pavement Condition Index Map shows the breakdown of condition and provides a good overview of the State of the City's streets.

As shown in the following table, Belmont's arterials are generally in good condition. The collectors and the residential streets are in satisfactory condition on average, but are also entering the onset of rapid failure stage.

2008 Weighted Average PCI by Functional Classification						
Classification	PCI	Good	Satisfactor y	Fair	Poor	Lane Miles
Arterial	79	8%	2%	1%	0%	14
Collector	65	17%	5%	5%	3%	35
Local/Residential	57	23%	13%	14%	10%	86
Total	62	48%	20%	20%	13%	135

Averaging PCIs over the entire City or functional class obscures the fact that individual street segment conditions range from excellent to failed. The majority of the failed roadways within the City are Local/Residential Roadways. The roadways in Poor condition are primarily Local roadways which do not have grant funding available for their repair.

The breakdown of all streets by condition category is shown below:

2008 Condition Distribution			
Condition Category	PCI Range	Percent	Lane Miles
Good	70 – 100	47%	63
Satisfactory	50 – 69	20%	27
Fair (Failing)	25 – 49	20%	27
Poor (Failed)	0 – 25	13%	18

At current estimated funding levels of \$415,000 per year, the overall PCI will drop several points per year to 55 in 2012. The deferred maintenance and rehabilitation backlog will grow from \$13 million to \$31 million.

The breakdown of all streets by condition category in 2012 under current funding is shown below:

2012 Condition Distribution			
Condition Category	PCI Range	Percent	Lane Miles
Good	70 – 100	48%	65
Satisfactory	50 – 69	13%	18
Fair (Failing)	25 – 49	14%	18
Poor (Failed)	0 – 25	25%	34

Current funding does not provide sufficient resources to improve Poor condition pavement. Currently 13% of City streets are in Poor condition. At the current level of funding, 25% of City streets will be in Poor Condition by 2012.

Currently around half of the City streets are in Good condition. If the City continues to dedicate the majority of its pavement funds toward Surface Treatment of roadways that are in Satisfactory and Good condition the City will manage to keep all those roadways already in Good condition from declining. The City will also be able to raise the condition of some roadways that are in Satisfactory condition, but more of those roadways that are in Satisfactory condition will decline to Fair Condition. An even larger percentage of roadways in Fair condition will decline to Poor condition.

Current funding levels are sufficient to keep the City's Good condition pavement in Good condition through slurry seal and thin overlay. But, current funding levels are not sufficient to keep the roadways that are in Satisfactory, Fair (failing), or Poor (failed) condition from

declining. At current funding levels another 12% of the City roadway system will have fallen into Poor condition, and failed, by 2012.

The current funding amount contrasts greatly with the optimum program suggested by MTC. Under the optimum scenario, cost to bring the entire City network up to a PCI of 85 within 6 years and entirely eliminate the backlog is estimated. The cost for this scenario is \$30 million. An alternative between the two would still be desirable and can be presented for consideration at a future meeting.

Discussion

Funding for Capital Street Construction

Most of the City's revenues for maintenance and street improvement are from the gasoline tax and Measure A sales tax. The City also receives vehicle impact fees from Allied Waste and in previous years from the C/CAG vehicle registration fee. The City anticipates receiving Proposition 1B funds for use over the next three years. The City may also use Redevelopment District Agency (RDA) funds for street improvements within the RDA district.

The following table shows these expected revenues for fiscal year 2008. The table shows the majority of revenues drawn from all sources, but it is not intended to correspond directly to the FY08 budget.

Fiscal Year 2008- Revenue for Street Improvement and Maintenance		
Gas Tax	\$717,128	38%
Sales Tax (Measure A)	\$470,000	25%
Vehicle Registration Fee	\$0	0%
Proposition 1B (Bond measure) - three year total \$417,617	\$139,205	7%
Federal Grants – (STIP for Old County Overlay)	\$134,000	7%
RDA – (Old County Overlay grant match)	\$41,000	2%
RDA	\$250,000	13%
Waste Vehicle Impact Fee	\$110,000	7%
AB 1546: Congestion Management Vehicle Registration Fee	\$10,000	1%
Total	\$1,871,333	100%

The City uses these revenues for all street improvements and maintenance activities. Street maintenance and improvements include pavement management, traffic operations and controls (signals, signage, markings, etc.) and street lights. Revenue cover cost to provide staff maintenance and engineering labor, equipment, materials, and construction.

Grant revenues, such as those secured for the overlay of Old County Road, also become available from time to time. These funds may only be used on Arterial and Collector Roadways and the City of Belmont must compete with other communities for these funds.

The City will use about one-half of its street revenues for pavement maintenance. This includes routine stop-gap maintenance performed by the City's crew for pothole repair and preventative maintenance such as crack sealing, project design and construction management performed by the City's engineering division. Contracts for slurry seal and AC pavement overlay projects in the amount of \$640,000 (including old County Road and RDA funding to supplement Measure A and Proposition 1B funds available for paving) are planned. Staff will present the proposed slurry seal and overlay project locations with next month's pavement rehabilitation priority report.

In the City 2007 paving program, a greater economy of scale was achieved by aggregating funds from several years and performing construction of one larger construction project rather than construction of a smaller project each year preceding. In the summer of 2007, the City of Belmont completed \$700,754 Slurry and Pavement projects as a part of two separate contracts.

General Plan/Vision Statement

The City's pavement management program is consistent with the General Plan. The Circulation Element, Description of Trafficways (Paragraph 2103) notes that there are a number of streets with substandard pavement condition and that the ongoing phased street overlay program will improve pavement condition and extend the life of existing streets.

Fiscal Impact

There is no fiscal impact from this informational report.

Public Contact

The Council agenda was posted.

Recommendation

Staff recommends that Council accept this informational report.

Alternatives

1. Take no action.
2. Refer back to staff for further information.

Attachments

A. PCI Map of Belmont Street

Respectfully submitted,

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ROAD NETWORK PAVEMENT CONDITION INDEX SUMMARY

